

Modernizing Solid Waste Management in Resen



Transferable Solution

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Project Title: Modernizing the existing landfill according to environmental standards and solving the problem of solid waste management in Resen

Leader: JKP Proleter (Resen, Republic of Macedonia)

Partner: Hydroprojekt Consulting Engineers (Prague, Czech Republic)

Location: Resen, Republic of Macedonia

Project Duration: March 2001- September 2001

EcoLinks Project Investment: Total Project Investment: \$ 68,824 ; EcoLinks Grant Support: \$ 47,155; Project Team Cost Share Contribution: \$ 21,669.

Best Practice: Transferable Solution

This is a Best Practice because it established a methodology for empowering a local community in Macedonia to address solid waste management problems as well as build economic opportunities. The project established a model for improving solid waste management in cases where local resources are especially limited (i.e., small and medium sized developing municipalities and regions), but the need to upgrade solid waste management practices is high. The project methodology includes building a new landfill, promoting recycling and composting, closing down illegal dumps, and raising public awareness. It is especially valuable in that it simultaneously reduces the environmental impacts of solid waste disposal as well as generates municipal income.

Project Summary

The town of Resen is located near Lake Prespa in the southwestern part of the Republic of Macedonia. While the region is rich with agricultural productivity, it has few resources for improvements to the infrastructure. The solid waste management facilities and practices need to be upgraded to protect drinking water supplies, important agricultural activities (especially fruit orchards), and a growing tourist industry around Lake Prespa. To improve solid waste management in the region, however, economic challenges must also be addressed.

The existing solid waste management program in Resen involves several challenges including: 1) inefficient means for the collection and disposal of solid waste (e.g., insufficient number of collection containers); 2) high maintenance transportation vehicles with high operation costs; 3) no program for reducing and recycling waste; and 4) dumpsites that do not meet environmental standards.

Resen's existing regional landfill degrades groundwater resources due to harmful, uncontrolled leachate. Landfill leachate consisting of heavy metals and harmful organic compounds pollutes groundwater resources as it contaminates water that passes from surface areas to underground layers. Analyzed samples of groundwater taken from boreholes around the existing Resen landfill exceed Maximal Admissible Concentrations of certain leachate pollutants according to Macedonian Regulations. For example, the samples contained high levels of dangerous hazardous materials such as lead and mercury. High levels of chloride were also present.

Apple and grape orchards are the region's main sources of economic vitality. The region produces approximately 60-70 million kilograms of apples each year. The fruit production and processing industry is, however, threatened by contaminated groundwater resources. An apple orchard near the landfill could be contaminated with high levels of heavy metals and pathogens that originate from groundwater polluted from household and industrial waste.

A strategy for reducing, separating, recycling, and composting waste was lacking. For example, approximately 60% of the total waste produced in the region is organic waste. While composting vegetation produces a high quality soil, household compost can only be used as landfill cover. Separating and composting organic waste would reduce landfill waste, prevent the misuse of household generated compost, and generate new resources (i.e., soil and landfill cover). Composting, furthermore, reduces the amount of waste that is collected and sent to the landfill. Incentives to participate in the reduction, separation, and recycling of waste could involve a new disposal fee system based on the amount of waste generated rather than the current system in which fees are based on the size of the generator's yard and dwelling or office space.

With the assistance of the EcoLinks Challenge Grant Program, Proleter Resen in the Republic of Macedonia; Hydroprojekt Consulting Engineers from the Czech Republic; and Geing Krebs und Kiefer of Skopje in the Republic of Macedonia collaborated to develop a modern system for managing municipal and industrial solid waste in the region. The project focused on developing economically favorable ways

to minimize environmental impacts, reduce waste production, and improve collection, transportation, recycling, composting, and reuse options.

By implementing the program developed by this project, Resen promotes efficient solid waste management and can build a new landfill that averts groundwater contamination from leachate and generates economic benefits by inviting additional users from the region. Landfill space and resources are used more efficiently through waste reduction, separation, reuse, recycling, and composting. A new collection and disposal fee system based on the amount of waste generated could provide the necessary incentives to enjoin broad public support and participation in a new program.

Project Activities

This project involved several activities to establish a waste management program in the region. The individual activities that make up this project are outlined in detail below.

1. Gathered and evaluated background information on waste management in the area.

Action: Data collection and analysis were conducted to establish a knowledge base for developing a solid waste management program and included the following:

- 1) Conducted a comparison of Macedonian legislation and European Union standards regarding waste management requirements;
- 2) Classified municipal waste;
- 3) Classified solid municipal waste according to residential development type;
- 4) Determined waste management conditions in the region;
- 5) Estimated the amount and composition of both municipal and industrial solid waste produced in the region;
- 6) Clarified the fee system for collection and deposition of one ton of solid waste including payment model for waste collection;
- 7) Analyzed waste collection, transportation and landfill deposit practices including a review of containers and vehicles;
- 8) Estimated the present costs associated with the collection and transportation of waste; and
- 9) Conducted economic analysis of present fee system for waste disposal.

Product(s): 1) Report on the existing waste management effort in Resen.

2. Established waste management strategy and objectives.

Action: Outlined a municipal waste management approach to avoiding environmental impacts. This outline included waste reduction strategies and benefits at municipal, business, and household levels. It also summarized the sorting, collection, and processing of recyclable materials including an evaluation of current collection systems.

Product(s): Waste management strategy and objectives.

3. Investigated existing and newly proposed landfill site.

Action: The parameters for conducting research on the geomechanical and hydrogeological conditions of the landfill area were defined. Conducted geological and hydrogeological study of the landfill area. Provided an overview of the geomorphologic characteristics, geological status, geotectonic characteristics, hydrogeological conditions, and geological and hydrogeological characteristics of rock masses.

Geomechanical drilling was conducted to investigate the soil and underground geological characteristics.

Product(s): 1) Report on geotechnical investigations of existing landfill in Resen area
2) Report on groundwater quality of existing municipal landfill in Resen.

4. Developed recommendations for solid municipal waste management.

Action: The amount and composition of municipal waste were projected for the year 2012. Household waste was characterized. Reuse and recycling possibilities and needs including the requirements for waste separation, storage and processing were identified. Waste collection equipment was reviewed and recommendations were developed regarding the transportation of waste, collection equipment, collection routes, and the location for separated waste collection containers.

Proposed SWM system modernization consists of five consequent implementation stages, scheduled to take place over a ten-year period (2002-2012). Total investment costs of the modernization amount to \$3.1 mill.

Recommended measures focused largely on upgrading the existing landfill.

Upgrading the existing landfill, considered a priority, was to be done gradually in all five stages. A major step towards upgrading the landfill, however, is scheduled in the first stage. Other recommended measures, to be implemented while upgrading the landfill, include: purchasing of equipment (bins, containers, waste collection and transportation vehicles, landfill machinery, etc.); closing the existing industrial waste dump site; closure and reclamation of other dump sites in the region; initiation, testing and gradual development of composting as well as paper, glass and PET separate collection and recycling activities; organization of public campaigns for education and awareness raising and improvement of legislation.

Developed a conceptual design for the reclamation of existing non-engineered dump sites in the area. Several of these local illegal dumpsites exist in the region. A plan for reclaiming these sites and transporting the waste to a local or regional landfill was developed. For example, a 60 cm thick layer of soil shall be spread and compacted over the landfills once storm runoff is diverted away from the landfill. A 30 cm layer of quality soil shall then be placed over the compacted soil and subsequently seeded with grass.

Product(s): 1) Projections regarding waste production for the year 2012 2) Reuse and recycling programmatic requirements 3) Waste collection and transportation equipment needs 4) Plan for reclaiming non-engineered dump sites.

5. Development plan for new landfill.

Action: Developed conceptual and structural design for new landfill. Identified and outlined main landfill facilities including site design, equipment, landfill biogas use and incineration, and composting. Developed landfill construction implementation plan.

Product(s): 1) Designs for new landfill 2) Report on biogas regarding new Resen landfill.

6. Calculated cost estimates and conducted an economic analysis of the proposed waste management program.

Action: The cost of constructing the new landfill was calculated including the cumulative unit prices of the main construction works. An economic analysis of the different variants in terms of annual revenues and corresponding costs was conducted using Hydroprojekt software. A financial analysis was conducted using the future-cash-flow method. The Internal Rate of Return (IRR) was also calculated. The fees for depositing and processing waste received at the landfill were determined.

Several financing alternatives with different combinations of financing sources and their investment shares were analyzed. The analyses were based on current operating costs, a 15% annual bank loan interest rate (to be obtained from a foreign bank), and a gradual increase in landfill dumping fees. Based on the analyses, an optimum solution for financing the first modernization stage (total investment outlays \$1.3 million) included: 5% equity capital, 70% subsidies (domestic and/or foreign), and 25% financing from internal sources. No bank loan was recommended for this stage. All consequent stages are to be financed from profits generated by landfill operations in combination with bank loans.

Product(s): 1) Economic and financial analyses of the newly proposed landfill 2) Fee system for waste disposal.

7. A public outreach campaign was conducted.

Action: Brochures and posters on solid waste collection, transportation and disposal were prepared and printed for distribution. Information about the project was broadcast over local radio. A presentation on the project was conducted for local authorities and the inhabitants of the Prespa region.

Product(s): 1) Information brochures 2) Campaign posters 3) Radio broadcasts 4) Project presentation.

Project Benefits

This project generated capacity building, environmental, and economic benefits. Through a public outreach campaign, public awareness and participation in waste reduction and recycling were strengthened. The capacity to reduce water and soil pollution and generate economic opportunities was established.

Capacity Building Benefits

The public outreach campaign developed and implemented as part of this project strengthened the capacity for expanding voluntary public participation in recycling and composting efforts. Broad public participation in waste separation, for example, is critical to the success of a recycling program. The success of a composting program also depends upon the voluntary support of the public. In addition, JKP Proleter, the Project Leader, learned the benefits of an integrated solid waste management approach that included measures to reduce and recycle solid waste materials.

Environmental Benefits

The solid waste management program and new landfill would provide the following environmental benefits:

- 1) Reduced water pollution: The existing landfill produces approximately 5000 liters of polluted water per week. With the new landfill contaminated water and leachate are controlled and precipitation, surface water, and groundwater are prevented from entering into the new landfill;
- 2) Avoided greenhouse gas emissions and energy resource opportunity: Landfill gases produced from the new landfill will be treated or converted which reduces greenhouse gas emissions and provides a viable energy resource; and
- 3) Waste minimization and resource use efficiency: Additionally, the waste management program developed in this project includes a significant reuse and recycling effort that reduces waste that ends up in the landfill and allows resources to be used more efficiently.

Measures will be taken with the new landfill to minimize nuisances and hazards including:

- Odor and dust emissions;
- Wind blown materials;
- Noise and traffic;
- Birds, vermin and insects; and
- Fires.

Economic Benefits

The most notable economic benefit derived through the implementation of the waste management program outlined by this project is the promotion of a solution to waste management problems in a small community that simultaneously strengthens the

regional economic situation. This project furthermore raises the question of initiating a more collaborative waste management program in the region. This would ultimately improve efficiency as well as help to generate local income from waste disposal services. The Prespa region produces 7,800 tons of solid municipal waste per year, while 25,000-30,000 tons of waste per year is needed in order to justify the unit costs for processing waste. By extending waste disposal services to other municipalities, the landfill quota would be met and the local community would generate an income from providing waste disposal services. The waste management program may be financed by a scheme involving state subsidies, grants (e.g., USAID, Phare), municipal resources, and bank loans.

Lessons Learned

The following lessons were learned during this project:

- Strong cooperation between project participants enhances the flow of information. In this case, for example, information about waste management, recycling and composting as well as EU standards was more readily available in the context of cooperation amongst the multiple project partners.
- Implementation of the project's framework for improving waste management is challenged by two main factors: 1) insufficient waste management legislation in the Republic of Macedonia, and 2) difficult economic and political conditions in the region. EU standards could only be met, at this stage, through a model project with the support of international and domestic private and public donors.

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